

We claim:

1. A liquid coating composition exhibiting improved whiteness, the composition comprising a polyester polymer or an alkyd polymer that includes one or more of the following, in an amount sufficient to improve the apparent whiteness of the coating composition:

a) a residue of one or more blue toner dyes that strongly absorb light at wavelengths from about 530 nm to about 650 nm, and one or more of:

i) a residue of one or more red toner dyes that strongly absorb light at wavelengths from about 470 nm to about 580nm, or

ii) a residue of one or more violet toner dyes that strongly absorb light at wavelengths from about 500 nm to about 610 nm; or

b) a residue of one or more reddish-blue toner dyes that strongly absorb light at wavelengths from about 520 nm to about 630 nm, and optionally, one or more of:

i) a residue of one or more red toner dyes that strongly absorb light at wavelengths from about 470 nm to about 580nm, or

ii) a residue of one or more violet toner dyes that strongly absorb light at wavelengths from about 500 nm to about 610 nm.

2. The liquid coating composition according to claim 1, wherein the composition further comprises at least one polymer subject to yellowing.

3. The liquid coating composition according to claim 2, wherein the at least one polymer subject to yellowing comprises a latex polymer.

4. The liquid coating composition according to claim 1, wherein the liquid coating composition comprises water.

5        5. The liquid coating composition according to claim 1, wherein the liquid coating composition comprises one or more organic solvents.

6. The liquid coating composition according to claim 1, wherein the alkyd polymer is miscible with both water and organic solvents.

10        7. The liquid coating composition according to claim 1, wherein the one or more blue toner dyes strongly absorb light at wavelengths from 550 nm to 640 nm.

15        8. The liquid coating composition according to claim 1, wherein the one or more red toner dyes strongly absorb light at wavelengths from 480 nm to 570 nm.

20        9. The liquid coating composition according to claim 1, wherein the one or more violet toner dyes strongly absorb light at wavelengths from 510 nm to 600 nm.

25        10. The liquid coating composition according to claim 1, wherein the one or more reddish-blue toner dyes strongly absorb light at wavelengths from 540 nm to 620 nm.

11. The liquid coating composition according to claim 1, wherein the residue of the one or more blue toner dyes, the residue of the one or more red toner dyes, and the residue of the one or more violet toner dyes are

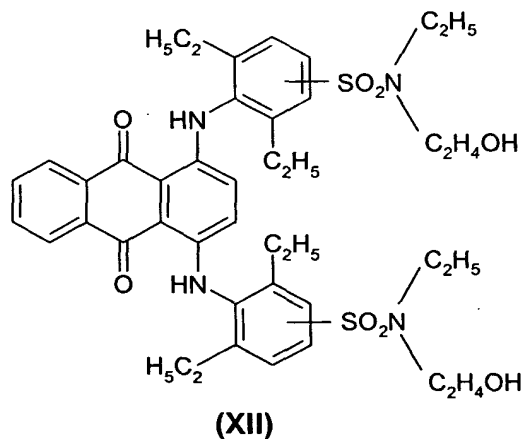
provided in the coating composition in a total amount of no more than about 350 ppmw, based on the total weight of the coating composition.

12. The liquid coating composition according to claim 1, wherein the  
5 residue of the one or more reddish-blue toner dyes is provided in the coating composition in a total amount of no more than about 350ppmw, based on the total weight of the coating composition.

13. The liquid coating composition according to claim 1, wherein the  
10 residue of the one or more blue toner dyes, the residue of the one or more red toner dyes, and the residue of the one or more violet toner dyes are provided in the coating composition in a total amount of from about 5 ppmw to about 40 ppmw, based on the total weight of the coating composition.

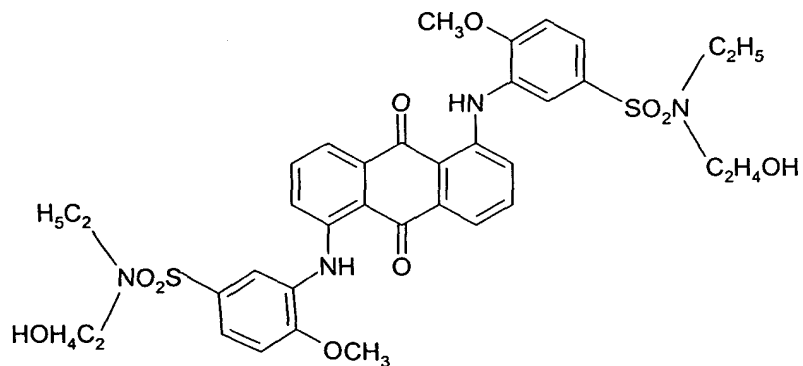
14. The liquid coating composition according to claim 1, wherein the  
15 residue of the one or more reddish-blue toner dyes is provided in the coating composition in a total amount of from about 5 ppmw to about 40 ppmw, based on the total weight of the coating composition.

20 15. The liquid coating composition according to claim 1, wherein the one or more blue toner dyes include the following:

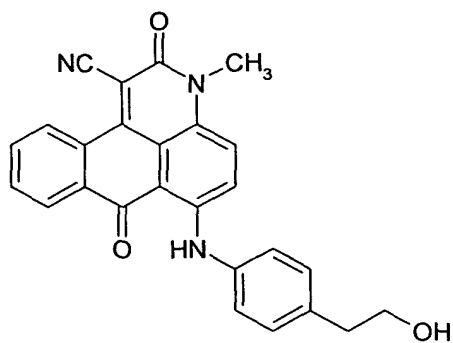


16. The liquid coating composition according to claim 1, wherein the one or more red toner dyes include the following:

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17. The liquid coating composition according to claim 1, wherein the one or more reddish-blue toner dyes include the following:



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18. A method of improving the apparent whiteness of a liquid coating composition, comprising adding to the liquid coating composition a polyester polymer or an alkyd polymer comprising one or more of the following, in an amount sufficient to improve the apparent whiteness of the coating composition:

15

a) a residue of one or more blue toner dyes that strongly absorb light at wavelengths from about 530 nm to about 650 nm, and one or more of:

5           i) a residue of one or more red toner dyes that strongly absorb light at wavelengths from about 470 nm to about 580 nm, or

          ii) a residue of one or more violet toner dyes that strongly absorb light at wavelengths from about 500 nm to about 610 nm; or

          b) a residue of one or more reddish-blue dyes that strongly absorb light at wavelengths from about 520 nm to about 630 nm.

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19. The method according to claim 18, wherein the coating composition comprises at least one polymer subject to yellowing.

15           20. The method according to claim 19, wherein the at least one polymer subject to yellowing comprises a latex polymer.

21. The method according to claim 18, wherein the alkyd resin is miscible with both water and organic solvents.

20           22. The method according to claim 18, wherein the one or more blue toner dyes strongly absorb light at wavelengths from 530 nm to 650 nm.

23. The method according to claim 18, wherein the one or more red toner dyes strongly absorb light at wavelengths from 470 nm to 580 nm.

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24. The method according to claim 18, wherein the one or more violet toner dyes strongly absorb light at wavelengths from 500 nm to 610 nm.

25. The method according to claim 18, wherein the one or more reddish-blue toner dyes strongly absorb light at wavelengths from 520 nm to 630 nm.

5           26. The method according to claim 18, wherein the residue of the one or more blue toner dyes, the residue of the one or more red toner dyes, and the residue of the one or more violet toner dyes are provided in the liquid coating composition in a total amount of no more than about 350 ppmw, based on the total weight of the liquid coating composition.

10           27. The method according to claim 18, wherein the residue of the one or more reddish-blue toner dyes is provided in the liquid coating composition in a total amount of no more than about 350ppmw, based on the total weight of the latex composition.

15           28. The method according to claim 18, wherein the residue of the one or more blue toner dyes, the residue of the one or more red toner dyes, and the residue of the one or more violet toner dyes are provided in the liquid coating composition in a total amount of from about 5 ppmw to about  
20 40 ppmw, based on the total weight of the liquid coating composition.

            29. The method according to claim 18, wherein the residue of the one or more reddish-blue toner dyes is provided in the liquid coating composition in a total amount of from about 5 ppmw to about 40 ppmw,  
25 based on the total weight of the liquid coating composition.

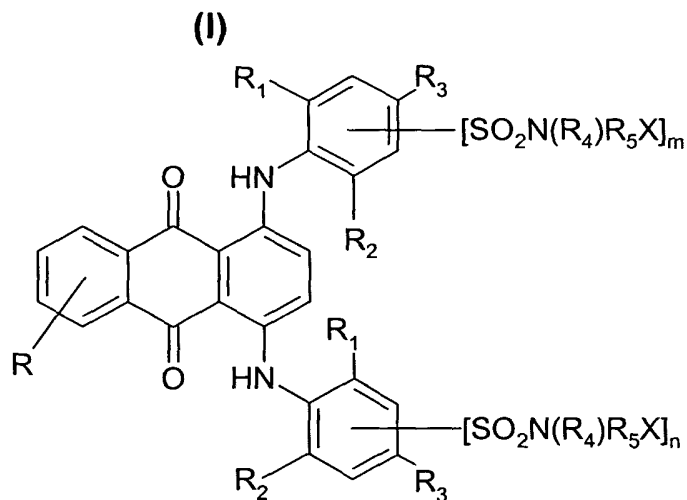
            30. A liquid coating composition, comprising: <sup>m</sup>

            (a) a water-dispersed condensation polymer having copolymerized therein, in amounts sufficient to improve the apparent whiteness of the

coating composition, toner dyes selected from one or more of the following two groups:

(1) at least one blue 1,4-bis(2,6-dialkylanilino)anthraquinone(s) toner dye of Formula (I):

5



wherein:

R is selected from the group consisting of hydrogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, halogen, carboxy and C<sub>1</sub>-C<sub>6</sub>-alkoxycarbonyl;

R<sub>1</sub> and R<sub>2</sub> are independently selected from bromo and C<sub>1</sub>-C<sub>6</sub>-alkyl;

R<sub>3</sub> is selected from the group consisting of hydrogen, halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkyl, hydroxy, C<sub>1</sub>-C<sub>6</sub>-alkoxy, substituted C<sub>1</sub>-C<sub>6</sub>-alkoxy, cyano, thiocyno, C<sub>1</sub>-C<sub>6</sub>-alkylthio, substituted C<sub>1</sub>-C<sub>6</sub>-alkylthio, C<sub>1</sub>-C<sub>6</sub>-alkylsulfonyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkylsulfonyl, C<sub>1</sub>-C<sub>6</sub>-alkoxycarbonyl, carboxy, aryloxy, arylthio, arylsulfonyl, and SO<sub>2</sub>N(R<sub>4</sub>)R<sub>5</sub>X when m and/or n are zero;

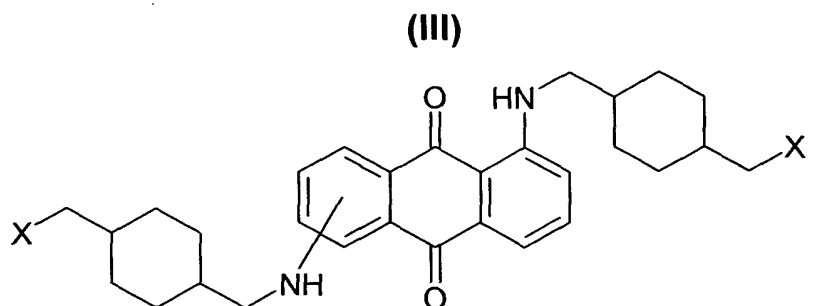
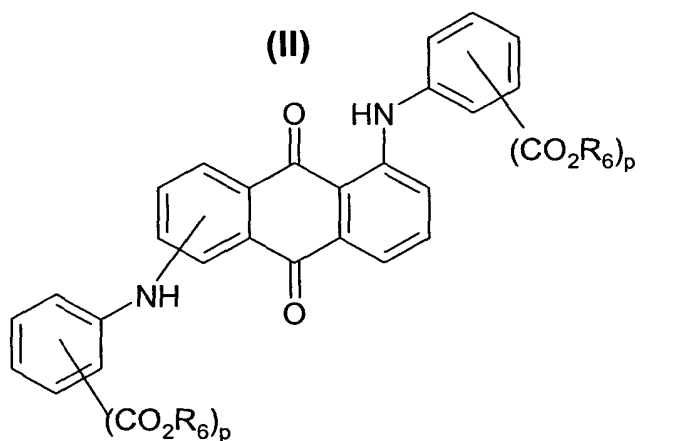
R<sub>4</sub> is selected from the group consisting of hydrogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>3</sub>-C<sub>8</sub>-alkenyl, C<sub>3</sub>-C<sub>8</sub>-alkynyl, C<sub>3</sub>-C<sub>8</sub>-cycloalkyl and aryl;

$R_5$  is a linking group selected from the group consisting of  $C_1$ - $C_8$ -alkylene,  $C_1$ - $C_6$ -alkylene-( $Z$ - $C_1$ - $C_6$ )<sub>1,2</sub>-alkylene, arylene- $C_1$ - $C_6$ -alkylene, arylene- $Z$ - $C_1$ - $C_6$ -alkylene,  $C_3$ - $C_7$ -cycloalkylene,  $C_1$ - $C_6$ -alkylene- $C_3$ - $C_8$ -cycloalkylene- $C_1$ - $C_6$ -alkylene,  $C_1$ - $C_6$ -alkylene-arylene- $C_1$ - $C_6$ -alkylene, and  
 5  $C_1$ - $C_6$ -alkylene- $Z$ -arylene- $Z$ - $C_1$ - $C_6$ -alkylene, wherein  $Z$  is selected from -O-, -S- or  $SO_2$  ;

$X$  is hydrogen or a polyester reactive group; and

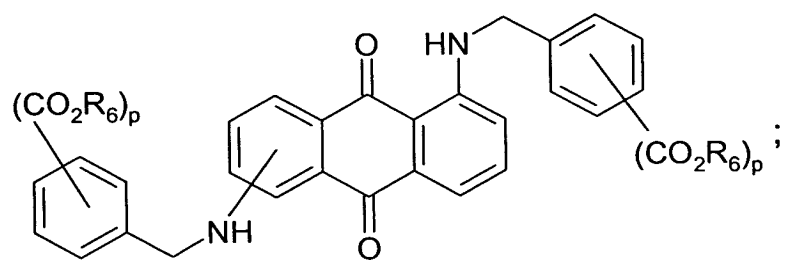
$m$  and  $n$  are independently 0 or 1; with the proviso that at least one polyester reactive group is present; and

10 at least one red or violet toner dye, which may be blended with one or more blue toner dyes of formula I above, corresponding to one or more of the following structural formulas II-X:



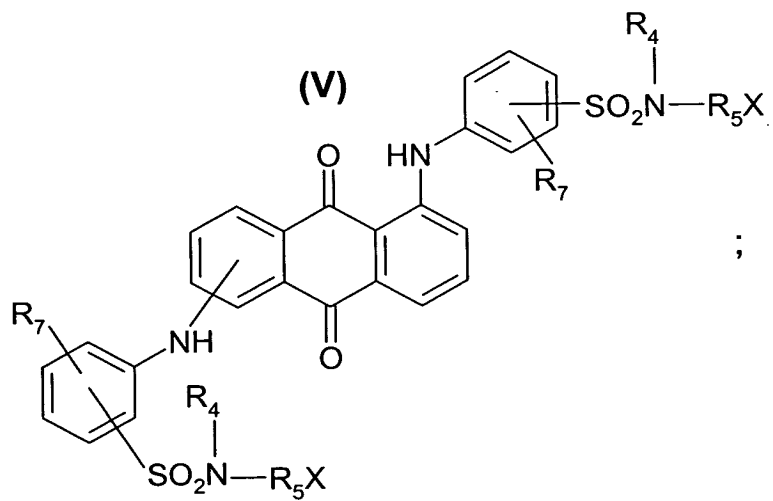


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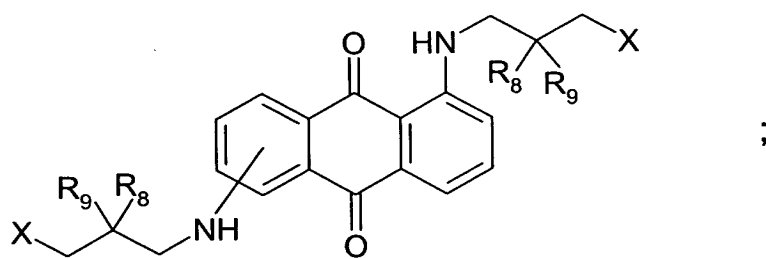


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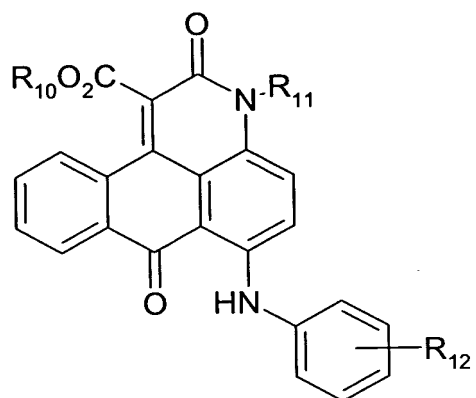
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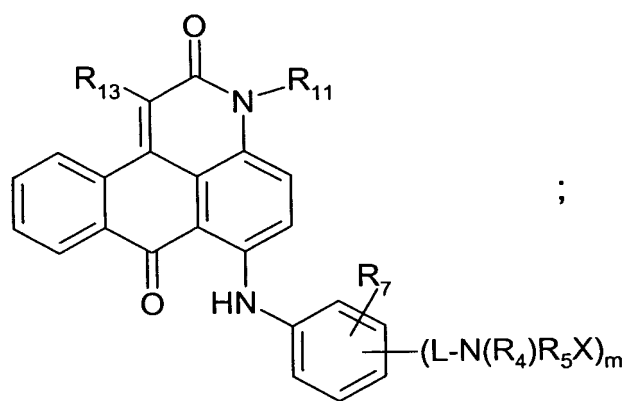
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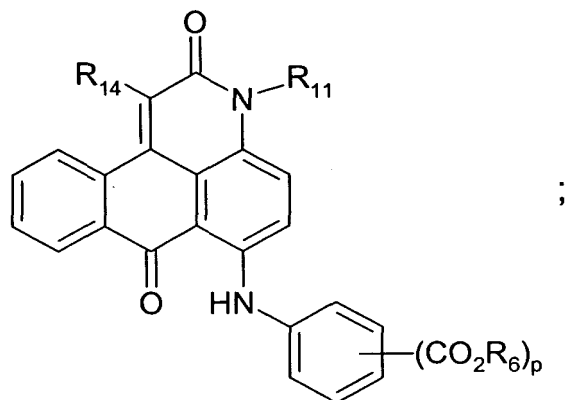
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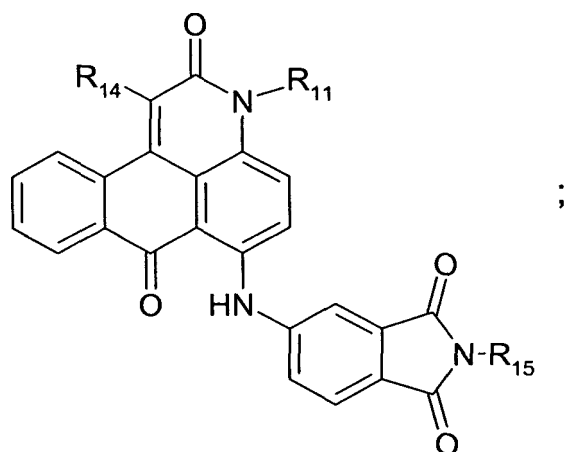
(VIII)



(IX)



(X)



wherein:

5           R<sub>6</sub> is selected from the groups consisting of hydrogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>3</sub>-C<sub>8</sub>-alkenyl, C<sub>3</sub>-C<sub>8</sub>-alkynyl, C<sub>3</sub>-C<sub>8</sub>-cycloalkyl or aryl;

          R<sub>7</sub> is hydrogen or one to three groups selected from C<sub>1</sub>-C<sub>6</sub>-alkyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkanoylamino, halogen, hydroxy, C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>6</sub>-alkylthio, substituted C<sub>1</sub>-C<sub>6</sub>-alkoxy, substituted C<sub>1</sub>-C<sub>6</sub>-alkylthio;

10

$R_8$  and  $R_9$  are the same or different and are selected from the group consisting of  $C_1$ - $C_6$ -alkyl, substituted  $C_1$ - $C_6$ -alkyl,  $C_3$ - $C_8$ -cycloalkyl or aryl;

$R_{10}$  is selected from the group consisting of  $C_1$ - $C_6$ -alkyl, substituted  $C_1$ - $C_6$ -alkyl,  $C_3$ - $C_8$ -cycloalkyl or aryl;

5             $R_{11}$  is selected from the group consisting of hydrogen,  $C_1$ - $C_{12}$ -alkyl, substituted  $C_1$ - $C_{12}$ -alkyl,  $C_3$ - $C_8$ -alkenyl,  $C_3$ - $C_8$ -alkynyl,  $C_3$ - $C_8$ -cycloalkyl and aryl;

10            $R_{12}$  is hydrogen or one to three groups selected from the group consisting of  $C_1$ - $C_6$ -alkyl, substituted  $C_1$ - $C_6$ -alkyl,  $C_1$ - $C_6$ -alkoxy, substituted  $C_1$ - $C_6$ -alkoxy,  $C_1$ - $C_6$ -alkylthio, substituted  $C_1$ - $C_6$ -alkylthio, halogen, hydroxy,  $C_1$ - $C_6$ -alkanoylamino, aroylamino,  $C_1$ - $C_6$ -alkylsulfonylamino and arylsulfonylamino;

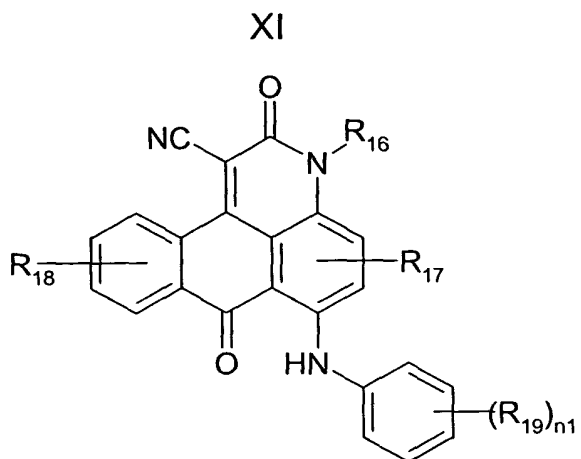
$R_{13}$  and  $R_{14}$  are selected from hydrogen, cyano or  $CO_2R_{10}$ ;

$R_{15}$  is  $R_4$  or  $R_5X$  as previously defined;

15            $L$  is  $-CO-$  or  $-SO_2-$ ;  $X$  is as previously defined;  $m$  is 0 or 1;  $p$  is 1 or 2; with the provision that at least one polyester reactive group is present as  $X$  or as a substituent on  $R_3$ ,  $R_4$ ,  $R_6$ ,  $R_7$ ,  $R_{10}$ ,  $R_{11}$ ,  $R_{12}$ ,  $R_{13}$ ,  $R_{14}$  or  $R_{15}$ ;

or

20           (2) at least one reddish-blue toner dye, optionally mixed with one or more red or violet components of Formulae II-X, having a structure consistent with Formula (XI):



wherein

R<sub>16</sub> is selected from hydrogen, C<sub>1</sub>-C<sub>12</sub>-alkyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>3</sub>-C<sub>8</sub>-cycloalkyl, C<sub>3</sub>-C<sub>8</sub>-alkenyl, C<sub>3</sub>-C<sub>8</sub>-alkynyl and aryl;

5 R<sub>17</sub> is selected from hydrogen, halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, substituted C<sub>1</sub>-C<sub>6</sub>-alkoxy, aryloxy, C<sub>1</sub>-C<sub>6</sub>-alkylthio, substituted C<sub>1</sub>-C<sub>6</sub>-alkylthio, arylsulfonyl and arylthio;

R<sub>18</sub> is selected from hydrogen, halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkyl, C<sub>1</sub>-C<sub>6</sub>-alkoxy and substituted C<sub>1</sub>-C<sub>6</sub>-alkoxy;

10 R<sub>19</sub> is selected from hydrogen or 1-3 groups selected from, halogen, C<sub>1</sub>-C<sub>6</sub>-alkyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkyl, aryl, C<sub>1</sub>-C<sub>6</sub>-alkoxy, substituted C<sub>1</sub>-C<sub>6</sub>-alkoxy, C<sub>1</sub>-C<sub>6</sub>-alkylthio, substituted C<sub>1</sub>-C<sub>6</sub>-alkylthio, C<sub>1</sub>-C<sub>6</sub>-alkoxycarbonyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkoxycarbonyl, arylthio, C<sub>1</sub>-C<sub>6</sub>-alkoxycarbonyloxy, substituted C<sub>1</sub>-C<sub>6</sub>-alkoxycarbonyloxy, carboxy, sulfamoyl, C<sub>1</sub>-C<sub>6</sub>-alkylsulfamoyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkylsulfamoyl, di-C<sub>1</sub>-C<sub>6</sub>-alkylsulfamoyl, substituted di-C<sub>1</sub>-C<sub>6</sub>-alkylsulfamoyl, C<sub>1</sub>-C<sub>6</sub>-alkylarylsulfamoyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkylarylsulfamoyl, C<sub>3</sub>-C<sub>8</sub>-cycloalkylsulfamoyl, substituted C<sub>3</sub>-C<sub>8</sub>-cycloalkylsulfamoyl, arylsulfamoyl, carbamoyl, C<sub>1</sub>-C<sub>6</sub>-alkylcarbamoyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkylcarbamoyl, di-C<sub>1</sub>-C<sub>6</sub>-alkylcarbamoyl, substituted di-C<sub>1</sub>-C<sub>6</sub>-alkylcarbamoyl, C<sub>1</sub>-C<sub>6</sub>-alkylarylcarbamoyl, substituted C<sub>1</sub>-C<sub>6</sub>-alkylarylcarbamoyl, C<sub>3</sub>-C<sub>8</sub>-cycloalkylcarbamoyl, substituted C<sub>3</sub>-C<sub>8</sub>-cycloalkylcarbamoyl, arylcarbamoyl, 2-pyrrolidono, C<sub>1</sub>-C<sub>6</sub>-alkanoylamino,

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substituted C<sub>1</sub>-C<sub>6</sub>-alkanoylamino, N-C<sub>1</sub>-C<sub>6</sub>-alkyl-C<sub>1</sub>-C<sub>6</sub>-alkanoylamino, or substituted N-C<sub>1</sub>-C<sub>6</sub>-alkyl-C<sub>1</sub>-C<sub>6</sub>-alkanoylamino; and

n<sub>1</sub> is an integer of 1 to 5; with the provision that that at least one polyester reactive group be present as X or as a substituent on R<sub>16</sub>, R<sub>17</sub>, R<sub>18</sub> or R<sub>19</sub>; and

(b) a polymer that is subject to yellowing.

31. The liquid coating composition according to claim 30, wherein the residue of the one or more blue toner dyes, the residue of the one or more red toner dyes, and the residue of the one or more violet toner dyes are provided in the coating composition in a total amount of no more than about 350 ppmw, based on the total weight of the coating composition.

32. The liquid coating composition according to claim 30, wherein the residue of the one or more reddish-blue toner dyes is provided in the coating composition in a total amount of no more than about 350 ppmw, based on the total weight of the coating composition.

33. The liquid coating composition according to claim 31, wherein the residue of the one or more blue toner dyes, the residue of the one or more red toner dyes, and the residue of the one or more violet toner dyes are provided in the coating composition in a total amount of from about 5 ppmw to about 40 ppmw, based on the total weight of the coating composition.

34. The liquid coating composition according to claim 32, wherein the residue of the one or more reddish-blue toner dyes is provided in the coating composition in a total amount of from about 5 ppmw to about 40 ppmw, based on the total weight of the coating composition.

35. A liquid coating composition exhibiting improved apparent whiteness and a reduction in the amount of yellowing that occurs upon exposure to heat and light, the composition comprising a polyester or alkyd polymer comprised of the following residues:

5           (a) one or more toner residues, provided in an amount sufficient to improve the apparent whiteness of the coating composition, comprising one or more of:

10                 1) a residue of one or more blue toner dyes that strongly absorb light at wavelengths from about 530 nm to about 650 nm, and one ore more of:

                      i) a residue of one or more red toner dyes that strongly absorb light at wavelengths from about 470 nm to about 580 nm, or

15                 ii) a residue of one or more violet toner dyes that strongly absorb light at wavelengths from about 500 nm to about 610 nm; or

                      2) a residue of one or more reddish- blue toner dyes that strongly absorb light at wavelengths of from about 520 nm to about 630 nm, and optionally, one or more of:

20                 i) a residue of one or more red toner dyes that strongly absorb light at wavelengths from about 470 nm to about 580 nm, or

25                 ii) a residue of one or more violet toner dyes that strongly absorb light at wavelengths from about 500 nm to about 610 nm;

                      (b) at least one difunctional dicarboxylic acid;

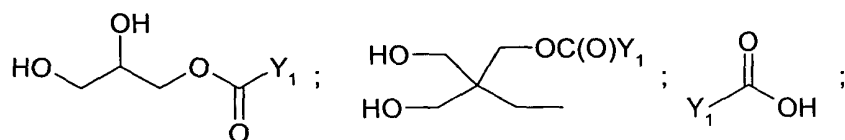
                      (c) from about 4 to about 25 mole percent, based on a total of all acid, hydroxyl and amino equivalents being equal to 200 mole percent, of at least one difunctional sulfomonomer containing at least one cationic

sulfonate group attached to an aromatic or cycloaliphatic nucleus wherein the functional groups are hydroxy, carboxyl or amino;

(d) at least one reactant selected from a glycol, a poly(ethylene glycol), a polyol, or a mixture of a glycol and a diamine having two -NHR<sub>20</sub> groups, wherein R<sub>20</sub> is selected from hydrogen and C<sub>1</sub>-C<sub>12</sub> alkyl

(e) optionally, at least one difunctional reactant selected from a hydroxycarboxylic acid having one -(C(R<sup>1</sup>))<sub>2</sub>-OH group, an amino-carboxylic acid having one -NR<sup>1</sup>H group, and an amino-alcohol having one -(C(R<sup>1</sup>))<sub>2</sub>-OH group and one -NR<sup>1</sup>H group, or mixtures of said difunctional reactants; wherein each R<sup>1</sup> is a hydrogen atom or an alkyl group of 1 to 4 carbon atoms; and

(f) optionally, a monobasic fatty acid, a fatty ester, or a naturally-occurring, partially-saponified oil comprising one or more of:

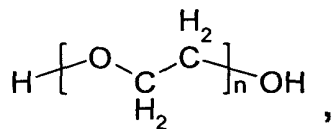


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wherein Y<sub>1</sub> is a C<sub>8</sub>-C<sub>20</sub> alkyl or alkenyl group.

36. The liquid coating composition according to claim 35, wherein the poly(ethylene glycol) includes one or more of the following:

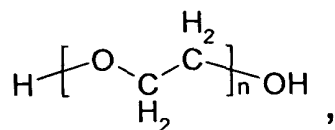
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wherein n is an integer from 2 to 20, or

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wherein n is an integer from about 20 to about 500.

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37. The liquid coating composition according to claim 35, wherein the one or more toner residues is provided in an amount sufficient to prevent or mask yellowing of the liquid coating composition.

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38. The liquid coating composition according to claim 35, wherein the one or more toner residues are provided in the coating composition in an amount of less than about 350 ppmw, based on the total weight of the liquid coating composition.

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39. The liquid coating composition according to claim 35, wherein the one or more toner residues are provided in an amount from about 5 ppmw to about 40 ppmw, based on the total weight of the liquid coating composition.